

Amendments to the Claims

Claim 1 (Currently Amended) A p-type semiconductor comprising a plurality of elements, one of the elements being a localized band formation element, the localized band formation element being which is isovalent with at least one other of the elements of which compose the p-type semiconductor and has having a smaller electronegativity than an electronegativity of said the at least one other element.

Claim 2 (Currently Amended) The p-type semiconductor according to Claim 1,
wherein another of the elements is further comprising an acceptor element, the acceptor element having which has fewer valence electrons than valence electrons of at least one other of the elements which compose of the p-type semiconductor.

Claim 3 (Currently Amended) The p-type semiconductor according to Claim 2,
wherein an amount of the localized band formation element in the p-type semiconductor is larger than an amount of the acceptor element in the p-type semiconductor.

Claim 4 (Currently Amended) The p-type semiconductor according to Claim 3,
wherein the acceptor element has a lower energy level than a top of an energy band of which the localized band formation element has.

Claim 5 (Original) The p-type semiconductor according to Claim 4,
wherein the acceptor element and the localized band formation element are distributed uniformly.

Claim 6 (Currently Amended) The p-type semiconductor according to Claim 5,
wherein an amount of the localized band formation element in the p-type semiconductor is 2 atom % or less.

Claim 7 (Original) The p-type semiconductor according to Claim 6,
wherein the p-type semiconductor is a compound semiconductor.

Claim 8 (Original) The p-type semiconductor according to Claim 7,
wherein the compound semiconductor is a nitride semiconductor.

Claim 9 (Currently Amended) The p-type semiconductor according to Claim 8,
wherein the nitride semiconductor has at least one Group III-elements element including
aluminum and at least one Group V element including nitrogen.

Claim 10 (Original) The p-type semiconductor according to Claim 9,
wherein the acceptor element is at least one of carbon, silicon, germanium, tin, beryllium,
magnesium, zinc and cadmium.

Claim 11 (Original) The p-type semiconductor according to Claim 10,
wherein the localized band formation element is at least one of phosphorus, arsenic and
antimony.

Claim 12 (Currently Amended) The p-type semiconductor according to Claim 8,
wherein the nitride semiconductor is a compound semiconductor which has at least one
Group III-elements element including boron and at least one Group V-elements element
including nitrogen.

Claim 13 (Original) The p-type semiconductor according to Claim 7,
wherein the compound semiconductor is an oxide semiconductor.

Claim 14 (Currently Amended) The p-type semiconductor according to Claim 13,
wherein the oxide semiconductor is a compound semiconductor which has at least one
Group II-elements element including zinc and at least one Group VI-elements element including
oxygen.

Claim 15 (Original) The p-type semiconductor according to Claim 14,
wherein the acceptor element is at least one of nitrogen, phosphorus, arsenic and
antimony.

Claim 16 (Original) The p-type semiconductor according to Claim 15,

wherein the localized band formation element is at least one of sulfur, selenium and tellurium.

Claim 17 (Currently Amended) The p-type semiconductor according to Claim 13,

wherein the oxide semiconductor is a compound semiconductor which has at least one Group II-elements element including beryllium and at least one Group VI-elements element including oxygen.

Claim 18 (Currently Amended) The p-type semiconductor according to Claim 3,

wherein an energy gap between an energy level of which the acceptor element has and a top of an energy band of which the localized band formation element has is higher than a thermal energy at a temperature when said the p-type semiconductor is used.

Claim 19 (Withdrawn - Currently Amended) The p-type semiconductor according to Claim 2,

wherein a part of the p-type semiconductor including the acceptor element and a part of the p-type semiconductor including the localized band formation element are separated spatially.

Claim 20 (Withdrawn – Currently Amended) The p-type semiconductor according to Claim 19,

wherein the part of the p-type semiconductor including the acceptor element and the part of the p-type semiconductor including the localized band formation element are different semiconductors.

Claim 21 (Withdrawn – Currently Amended) The p-type semiconductor according to Claim 20,

wherein the part of the p-type semiconductor including the acceptor element and the part of the p-type semiconductor including the localized band formation element are semiconductors with different crystal structures.

Claim 22 (Currently Amended) The p-type semiconductor according to Claim 1,

wherein the p-type semiconductor is a nitride semiconductor which has a crystal defect caused by missing of a Group III element, and

wherein the localized band formation element is at least one of phosphorus, arsenic and antimony.

Claim 23 (Currently Amended) The p-type semiconductor according to Claim 1,

wherein another of the elements is further comprising an acceptor element, the acceptor element having which has fewer valence electrons than valence electrons of at least one other of the elements of which compose the p-type semiconductor, and

wherein the acceptor element has a lower energy level than a top of an energy band of which the localized band formation element has.

Claim 24 (Currently Amended) The p-type semiconductor according to Claim 1,

wherein another of the elements is further comprising an acceptor element, the acceptor element having which has fewer valence electrons than valence electrons of at least one other of the elements of which compose the p-type semiconductor, and

wherein the acceptor element and the localized band formation element are distributed uniformly.

Claim 25 (Currently Amended) The p-type semiconductor according to Claim 1,

wherein an amount of the localized band formation element in the p-type semiconductor is 2 atom % or less.

Claim 26 (Original) The p-type semiconductor according to Claim 1,

wherein the p-type semiconductor is a compound semiconductor.

Claim 27 (Original) The p-type semiconductor according to Claim 1,

wherein the p-type semiconductor is a nitride semiconductor.

Claim 28 (Currently Amended) The p-type semiconductor according to Claim 1,

wherein the p-type semiconductor is a nitride semiconductor which has at least one

Group III element-elements including aluminum and at least one Group V element including nitrogen.

Claim 29 (Currently Amended) The p-type semiconductor according to Claim 1,
wherein the p-type semiconductor is a nitride semiconductor and another of the elements
is which includes an acceptor element, the acceptor element having which has fewer valence
electrons than valence electrons of at least one other of the elements of which compose the p-
type semiconductor, and

wherein the acceptor element is at least one of carbon, silicon, germanium, tin, beryllium,
magnesium, zinc and cadmium.

Claim 30 (Currently Amended) The p-type semiconductor according to Claim 1,
wherein the p-type semiconductor is a nitride semiconductor, and
wherein the localized band formation element is at least one of phosphorus, arsenic and
antimony.

Claim 31 (Currently Amended) The p-type semiconductor according to Claim 1,
wherein the p-type semiconductor is a nitride semiconductor which has at least one
Group III element-elements including boron and at least one Group V element-elements
including nitrogen.

Claim 32 (Original) The p-type semiconductor according to Claim 1,
wherein the p-type semiconductor is an oxide semiconductor.

Claim 33 (Currently Amended) The p-type semiconductor according to Claim 1,
wherein the p-type semiconductor is an oxide semiconductor which has at least one
Group II element-elements including zinc and at least one Group VI element-elements including
oxygen.

Claim 34 (Currently Amended) The p-type semiconductor according to Claim 1,
wherein the p-type semiconductor is an oxide semiconductor and another of the elements

~~is which includes~~ an acceptor element which has fewer valence electrons than valence electrons of at least one other of the elements of which compose the p-type semiconductor, and

wherein the acceptor element is at least one of nitrogen, phosphorus, arsenic and antimony.

Claim 35 (Currently Amended) The p-type semiconductor according to Claim 1,
wherein the compound semiconductor is an oxide semiconductor, and
wherein the localized band formation element is at least one of sulfur, selenium and tellurium.

Claim 36 (Currently Amended) The p-type semiconductor according to Claim 1,
wherein the p-type semiconductor is an oxide semiconductor which has at least one Group II element-elements including beryllium and at least one Group VI element-elements including oxygen.

Claim 37 (Currently Amended) The p-type semiconductor according to Claim 1,
wherein another of the elements is further comprising an acceptor element, the acceptor element having which has fewer valence electrons than valence electrons of at least one other of the elements of which compose the p-type semiconductor, and
wherein an energy gap between an energy level of which the acceptor element has and a top of an energy band of which the localized band formation element has is higher than a thermal energy at a temperature when the p-type said semiconductor is used.

Claim 38 (Withdrawn - Currently Amended) A semiconductor device comprising a plurality of having a layered structure which composes semiconductor layers forming a layered structure, at least one of the semiconductor layers being which includes a p-type semiconductor layer,
wherein the p-type semiconductor layer includes a plurality of elements, one of the elements being a localized band formation element, the localized band formation element being which is isovalent with at least one other of the elements of which compose the p-type semiconductor and having a has smaller electronegativity than the at least one other said element.

Claim 39 (Withdrawn - Currently Amended) The semiconductor device according to Claim 38,

wherein the p-type semiconductor layer is in contact-contacts with an electrode with a junction.

Claim 40 (Withdrawn - Currently Amended) The semiconductor device according to Claim 39,

wherein a top of a valence band of a semiconductor layer in contact with-contacted to the p-type semiconductor layer is lower than a bottom of an energy band of which the localized band formation element has in the p-type semiconductor layer.

Claim 41 (Withdrawn - Currently Amended) The semiconductor device according to Claim 39,

wherein energy gap between a top of a valence band of a semiconductor layer in contact with-contacted to the p-type semiconductor layer and a bottom of an energy band of which the localized band formation element has in the p-type semiconductor layer is smaller than a thermal energy at a temperature when the-said semiconductor device is used.

Claim 42 (Withdrawn - Currently Amended) The semiconductor device according to Claim 38,

wherein the-said semiconductor device is a light-emitting semiconductor device.

Claim 43 (Withdrawn - Currently Amended) The semiconductor device according to Claim 38,

wherein a top of a valence band of a semiconductor layer in contact with-contacted to the p-type semiconductor layer is lower than a bottom of an energy band of which the localized band formation element has in the p-type semiconductor layer.

Claim 44 (Withdrawn - Currently Amended) The semiconductor device according to Claim 38,

wherein an energy gap between a top of a valence band of a semiconductor layer in contact with contacted to the p-type semiconductor layer and a bottom of an energy band of which the localized band formation element has in the p-type semiconductor layer is smaller than a thermal energy at a temperature when said the semiconductor device is used.

Claim 45 (Withdrawn - Currently Amended) A hetero-junction semiconductor material comprising:

 a p-type semiconductor layer; and
 a target material layer which contacts with the p-type semiconductor layer with a junction and where holes are implanted from the p-type semiconductor layer,
 wherein the p-type semiconductor layer comprises a plurality of elements, the elements including includes:
 an acceptor element which has fewer valence electrons than at least one other of the elements of which compose the p-type semiconductor layer, and
 a localized band formation element which is isovalent with at least one element of elements which compose the p-type semiconductor layer and has a smaller electronegativity than the at least one said element, and
 wherein the target material layer includes one constituent element which has a smaller electron affinity than at least one of the elements of which compose the p-type semiconductor layer.

Claim 46 (Withdrawn - Currently Amended) The hetero-junction semiconductor material according to Claim 45,

 wherein the localized band formation element has an energy band at a same or lower energy level than an energy at a top of a valence band of the target material layer.

Claim 47 (Withdrawn) The hetero-junction semiconductor material according to Claim 46,
 wherein the target material layer further includes the acceptor element.

Claim 48 (Withdrawn) The hetero-junction semiconductor material according to Claim 47,
 wherein the p-type semiconductor layer has a smaller lattice constant than a lattice

constant of the target material layer and a tensile distortion at a junction part between the p-type semiconductor layer and the target material layer.

Claim 49 (Withdrawn - Currently Amended) The hetero-junction semiconductor material according to Claim 48,

wherein the p-type semiconductor layer has a different crystal structure than ~~from~~ a crystal structure of the target material layer.

Claim 50 (Withdrawn - Currently Amended) The hetero-junction semiconductor material according to Claim 49,

wherein ~~there is no defect or dangling bond in~~ a junction part between the p-type semiconductor layer and the target material layer is free from defect or dangling bond.

Claim 51 (Withdrawn - Currently Amended) The hetero-junction semiconductor material according to Claim 50,

wherein at ~~in~~ a junction part between the p-type semiconductor layer and the target material layer, one or both of plane directions of the p-type semiconductor and target material ~~both~~ layers and a direction of atomic arrangements in a plane are different.

Claim 52 (Withdrawn – Currently Amended) The hetero-junction semiconductor material according to Claim 51,

wherein the p-type semiconductor layer has an amorphous structure or a polycrystalline structure.

Claim 53 (Withdrawn - Currently Amended) The hetero-junction semiconductor material according to Claim 52,

wherein the target material layer is an n-type semiconductor layer of ~~with~~ high concentration.

Claim 54 (Withdrawn - Currently Amended) The hetero-junction semiconductor material according to Claim 53,

wherein the target material layer is an aluminum indium gallium nitrogen layer; an amount of indium being is 0~100% and an amount of aluminum being is 0~100%.

Claim 55 (Withdrawn) The hetero-junction semiconductor material according to Claim 54,
wherein the p-type semiconductor layer is a nitride semiconductor layer.

Claim 56 (Withdrawn - Currently Amended) The hetero-junction semiconductor material according to Claim 55,

wherein the target material layer is a gallium nitride layer and the p-type semiconductor layer is a boron aluminum gallium nitrogen layer; layer, an amount of boron is being 0~100% and an amount of gallium is being 0~100%.

Claim 57 (Withdrawn – Currently Amended) The hetero-junction semiconductor material according to Claim 56,

wherein the p-type semiconductor layer is an aluminum nitride layer and the localized band formation element is phosphorus or arsenic.

Claim 58 (Withdrawn - Currently Amended) The hetero-junction semiconductor material according to Claim 47, further comprising an intermediate layer where compositions of the p-type semiconductor layer and the target material layer are mixed mix between the p-type semiconductor layer and the target material layer.

Claim 59 (Withdrawn) The hetero-junction semiconductor material according to Claim 45,
wherein the p-type semiconductor layer is an oxide semiconductor layer.

Claim 60 (Withdrawn) The hetero-junction semiconductor material according to Claim 45,
wherein the p-type semiconductor layer is a fluoride semiconductor layer.

Claim 61 (Withdrawn) The hetero-junction semiconductor material according to Claim 45,
wherein the p-type semiconductor layer is a buffer layer.

Claim 62 (Withdrawn) A semiconductor device comprising a semiconductor device according to Claim 45,

wherein the target material layer further includes the acceptor element.

Claim 63 (Withdrawn) The hetero-junction semiconductor material according to Claim 45,

wherein the p-type semiconductor layer has a smaller lattice constant than a lattice constant of the target material layer and a tensile distortion at a junction part between the p-type semiconductor layer and the target material layer.

Claim 64 (Withdrawn - Currently Amended) The hetero-junction semiconductor material according to Claim 45,

wherein the p-type semiconductor layer has a different crystal structure than from a crystal structure of the target material layer.

Claim 65 (Withdrawn - Currently Amended) The hetero-junction semiconductor material according to Claim 45,

wherein there is no defect or dangling bond in a junction part between the p-type semiconductor layer and the target material layer is free from defect or dangling bond.

Claim 66 (Withdrawn - Currently Amended) The hetero-junction semiconductor material according to Claim 45,

wherein at in a junction part between the p-type semiconductor layer and the target material layer, one or both of plane directions of the p-type semiconductor and target material both layers and a direction of atomic arrangements in a plane are different.

Claim 67 (Withdrawn – Currently Amended) The hetero-junction semiconductor material according to Claim 45,

wherein the p-type semiconductor layer has an amorphous structure or a polycrystalline structure.

Claim 68 (Withdrawn - Currently Amended) The hetero-junction semiconductor material

according to Claim 45,

wherein the target material layer is an n-type semiconductor layer of with high concentration.

Claim 69 (Withdrawn - Currently Amended) The hetero-junction semiconductor material according to Claim 45,

wherein the target material layer is an aluminum indium gallium nitrogen layer; layer, an amount of indium is being 0~100% and an amount of aluminum is being 0~100%.

Claim 70 (Withdrawn - Currently Amended) The hetero-junction semiconductor material according to Claim 45,

wherein the target material layer is an aluminum indium gallium nitrogen layer; layer, an amount of indium is being 0~100% and an amount of aluminum is being 0~100%, and
wherein the p-type semiconductor layer is a nitride semiconductor layer.

Claim 71 (Withdrawn - Currently Amended) The hetero-junction semiconductor material according to Claim 45,

wherein the target material layer is a gallium nitride layer and the p-type semiconductor layer is a boron aluminum gallium nitrogen layer; layer, an amount of boron is being 0~100% and an amount of gallium is being 0~100%.

Claim 72 (Withdrawn - Currently Amended) The hetero-junction semiconductor material according to Claim 45,

wherein the target material layer is a gallium nitride layer, and
wherein the p-type semiconductor layer is an aluminum nitride layer and the localized band formation element is phosphorus or arsenic.

Claim 73 (Withdrawn - Currently Amended) The hetero-junction semiconductor material according to Claim 45, further comprising an intermediate layer where compositions of the p-type semiconductor layer and the target material layer are mixed mix between the p-type

semiconductor layer and the target material layer.

Claim 74 (Withdrawn - Currently Amended) A semiconductor device comprising hetero-junction semiconductor material,

wherein the hetero-junction semiconductor material includes:

_____ a p-type semiconductor layer; and

_____ a target material layer which contacts with the p-type semiconductor layer with a junction and where holes are implanted from the p-type semiconductor layer,

wherein the p-type semiconductor layer comprises a plurality of elements, the elements including includes:

_____ an acceptor element which has fewer valence electrons than at least one other of the elements of which compose the p-type semiconductor layer; and

_____ a localized band formation element which is isovalent with at least one of the elements of which compose the p-type semiconductor layer and has a smaller electronegativity than the at least one said element, and

wherein the target material layer includes one constituent element which has a smaller electron affinity than at least one of the elements of which compose the p-type semiconductor layer.

Claims 75 and 76 (Canceled)